

Memo

To: CCB

From: Phil Zuzolo, David Bacon, Steve Hoffert, R. A. Sarma

Date: August 17, 2000

Subject: PIDC 7.0 - **Upgrade to Atmospheric Transport Operations and Visual Analysis Processing**

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Abstract

We propose to install the PIDC 7.0 version of software for **Upgrade to Atmospheric Transport Operations and Visual Analysis Processing**, into PIDC 7.0 Operations. This software upgrades capabilities described in PIDC CCB-PRO-98/25 which are currently operational at the IDC under Release 2.1 (IDC TI 6.2.6, Biegalski et al., 1999). These changes will form the basis for PIDC7.0/IDC Release 3.0, which will be delivered, installed and validated at the International Data Centre (IDC) in the autumn of 2000. Notable changes in the **Atmospheric Transport Operations and Visual Analysis Processing** for PIDC 7 are **structured simulation data and FOR product output directories, addition of packed binary atmospheric transport processing formats, improved visual analysis capabilities, and visual data call back capabilities**. This release will also close **19 IDC Software Defect Report's (SDRs)**.

Statement of Objective

The objective of this proposal is to install a PIDC 7.0 version of **Atmospheric Transport Operations and Visual Analysis Processing** into PIDC operations to satisfy the requirements for radionuclide atmospheric transport processing support and visual analysis for the R3.0 delivery to the IDC enumerated with the related software listed in Appendix A, Table 1.

Summary of Proposed Change

We propose to install the upgraded **automatic-processing and interactive processing components of the atmospheric transport and visual analysis system** for the PIDC 7.0 release, listed in Appendix A, Table 1. This will result in changes to the OMEGA and HYSPLIT atmospheric transport simulation data output formats listed in Appendix B. Simulation data specification for-

mats. The simulation data are listed in Appendix B. Changes to the atmospheric transport simulation data were designed to better accommodate the manual archive to be accomplished by the IDC starting with PIDC 7.0. This manual archive will be via magnetic tape or mass store. We also propose to install the upgraded EDGE visual analysis and display software components to display of atmospheric transport data in support of the radionuclide monitoring system. Upgrades to the visual analysis and display software system include, where possible, those capabilities requested by the IDC and SDR fixes summarized in Appendix E, Table 7 for the fused display of related atmospheric transport, radionuclide, and seismic event data. This PIDC 7.0 software system, as well as patches, was installed and tested on the PIDC Sun Ultra hardware system. All software components, including patches, were built in the common environment under Solaris 2.7 using Oracle 8.1.5.0.0. Software was integrated on the PIDC Integration Testbed under the integration plan for PIDC 7.0.

Specific changes to the current IDC Release 2.1 operations software are listed below. These changes are specific to the IDC Release 3 SRR and the IDC Release 3 Implementation Plan. Additional details regarding these changes are provided in the appropriate user's guides.

- *OMEGA and HYSPLIT Atmospheric Transport Automated Processing*
 - Installation of OMEGA 5.0
 - Enhanced sleep mode for both OMEGA and HYSPLIT in the case of incomplete meteorological fields from NOAA.
 - Defined data output directories (Table 4) to support planned IDC R4 processing changes
 - Packed binary formats for the .adm particle trajectory (HYSPLIT and OMEGA), and .out meteorological fields (OMEGA) simulation data output.
- *EDGE Visual Analysis Automated Processing*
 - OMEGA and HYSPLIT packed binary particle trajectory data output files.
- *OMEGA and HYSPLIT Atmospheric Transport Interactive Processing*
 - Correction for OMEGA single point emission core dump.
- *EDGE Visual Analysis Interactive Processing*
 - Radionuclide site colorization according to published collection start and collection stop.
 - Data call back for visual analysis fields produced in the Environmental Work Bench (EWB) and output of the data into an ASCII text file.
 - Seismic event data display capability to color by specific value
 - Improved processing for EDGE model imports
 - An overview of the radionuclide/seismic visual data displays is provided in **Appendix G**
 - Update to daily operations procedures to include review and accounting of graphic FOR postings.

Expected Benefits

The proposed changes to be implemented with the PIDC 7.0 atmospheric transport and visual analysis software processing system are designed to both improve the speed of operational processing and allow the generation of better FOR products and simulations in support of radionuclide monitoring. In addition, the changes proposed for interactive processing will provide analysts with better tools for understanding the atmospheric transport relationship to radionuclide monitoring. The software upgrades include the 19 IDC SDRs listed in Table 7. Specific benefits expected for each of the proposed changes and related enhancements are summarized below.

- ***OMEGA and HYSPLIT Atmospheric Transport Automated Processing***

- **Installation of OMEGA 5.0.**

The installation of OMEGA version 5.0 will provide the IDC with a much improved regional atmospheric transport model for event recreation and regional monitoring. Among the improvements inherent in version 5.0 are fixes to many of the IDC SDRs relating to operations processing, and a more robust and valid system. These improvements will result in a faster and more efficient processing architecture.

- **Enhanced sleep mode for both OMEGA and HYSPLIT in the case of incomplete meteorological fields from NOAA.**

Enhancements to the sleep mode for the OMEGA and HYSPLIT automated processing system will prevent the initiation failure of atmospheric transport modeling due to incomplete meteorological data, or failed receipt of meteorological data, from NOAA. This improvement will prevent cases where atmospheric transport modeling fails to execute due to incomplete, or lack of new, data received from NOAA. The improvements will either delay processing until adequate data is received for processing, or will use the data from a previous date and time (if available) when no data is received. As a result, there will be fewer interrupts in the atmospheric transport model processing support to radionuclide monitoring operations.

- **Defined output directories (App. E, Table 4) to support IDC R4 processing changes.**

In preparation for future automation enhancements planned as follow-on IDC Release 3 processing, changes were required to the directory structure for ATM simulation data output. These directory structure changes were incorporated into the PIDC 7.0 processing system. The benefit of making these changes now are the following: 1) a stable output directory structure to better accommodate the ATM simulation data archive (*NOTE: permanent manual archive of simulation results via magnetic tape or mass store for Release 3 is the responsibility of the IDC.*) in conjunction with Release 3.0; 2) making the changes now will support future PIDC/IDC development activities; and 3) standardization of directory structure between the PIDC and IDC to better support comparison studies. A summary in App. E, Table 4, provides the specific directory structure.

- **Packed binary formats for the .adm particle trajectory (HYSPLIT and OMEGA), and (OMEGA) simulation data output.**

The addition of packed binary formats for the particle trajectory (.adm) has several benefits to the IDC with regard to atmospheric transport processing. First, the OMEGA system uses the

packed binary output as a standard for other operational processing sites. Thus the changes made at these other sites to improve processing will be more easily transferable to the IDC. Second, the packed binary formats take much less space than the previous formats and that will ease the burden for the manual archive process. Finally, the packed binary supports the future PIDC/IDC development activities while leveraging and sustaining the development path already initiated.

- ***EDGE Visual Analysis Automated Processing***

- **OMEGA and HYSPLIT packed binary .adm particle trajectory data output files.**

EDGE interface software used to read and analyze the .adm particle trajectory files will now process these files in the packed binary format. This will provide the added benefit to the IDC of processing the particle trajectory files for display much more efficiently will require much less memory for processing the packed binary files. Additionally the interface used to process these files will use memory more efficiently for faster processing. Specific processing times to be expected with these interface enhancements are provided in Appendix E, Table 5.

- ***OMEGA and HYSPLIT Atmospheric Transport Interactive Processing***

- **Correction for OMEGA single point emission core dump.**

The installation of OMEGA version 5.0 will correct this processing deficiency. This improvement will allow the IDC to process, on the fly, a single point emission at any location using the OMEGA software. As a result, the IDC will now have the capability to re-create a point source release particle dispersion.

- ***EDGE Visual Analysis Interactive Processing***

- **Colorization of Radionuclide stations according to sample categorization level.**

Changes were made to improve the interface which displays the radionuclide monitoring data collected at each radionuclide site. These improvements allow EDGE to correctly display the radionuclide stations according to the sample categorization level. The station colors change as the display time changes with respect to the collection start and collections stop using the following color scheme: GREEN--Level 1 and 2 samples; YELLOW--Level 3 samples; and RED--Level 4 and 5 samples. The site colors will change according to the specific collection start and collection stop date/time for each site sample. If no sample data are available, the site will remain GREEN. This enhancement corrects IDC SDR-169 and SDR-178.

- **Data call back for visual analysis fields produced in the Environmental Work Bench (EWB) and output of the data into an ASCII text file.**

This enhancement was added to the EDGE/EWB interface to provide the analyst with the capability to retrieve information from the interactive 3D/4D graphical displays at a position in 3D space. In addition, the data call back will include the capability to save the information retrieved from the specific position in 3D space.

- **Seismic event data display capability to color by specific value**

This enhancement will provide the ability to set a single seismic event threshold, or a range of specific values, for color display. The thresholds will be set interactively by the analyst and

may be based on seismic event magnitude, depth, or depth error. Thresholds may be set for more than one range or single criterion. Currently there is no capability to edit the event threshold values used for color display.

- **Improved processing for EDGE model imports**

In preparation for future processing architectures the data model import processing was enhanced to take advantage of multiple-processing hardware architectures. This capability will increase the speed of automated processing for the visual display of model data. Future applications which include routine particle stream displays as well as any automated display routines will benefit from this enhancement.

The installation of the above software components will enhance the PIDC operational flow. Figure 1 shows the general flow of simulation data and products for routine operations using the coarse resolution HYSPLIT atmospheric transport model. The boxes on the left side of the figure with the dotted lines indicate the upgraded capabilities

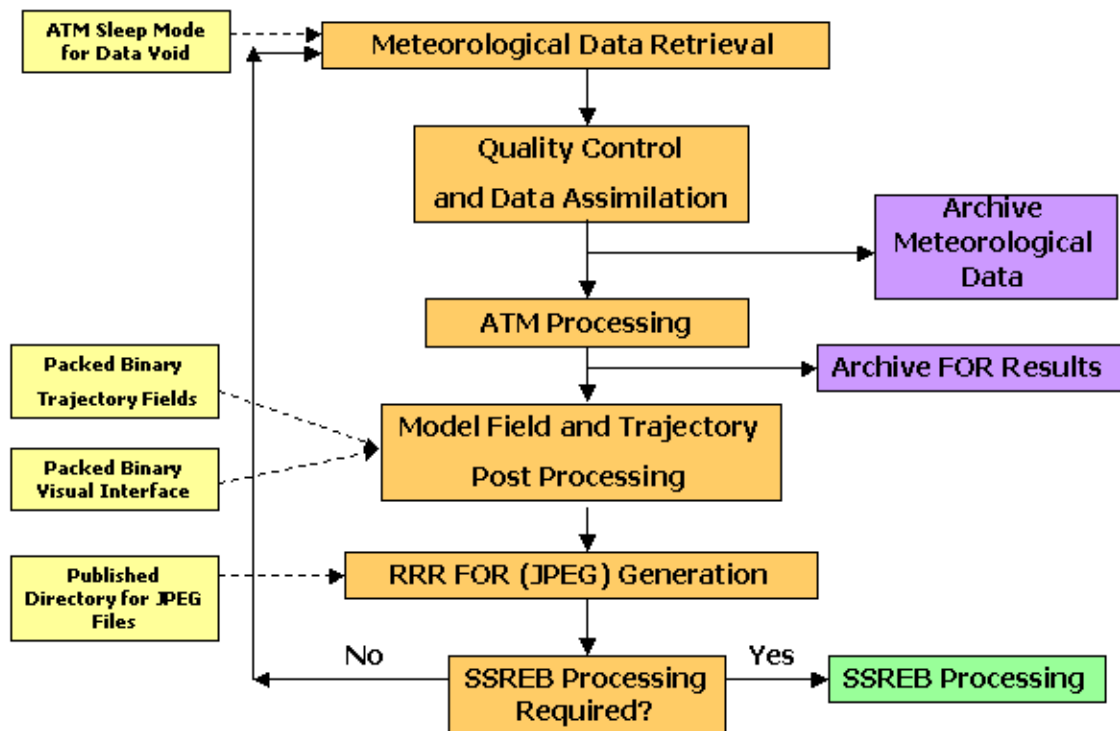


Figure 1. RRR (HYSPLIT) Operations Flow

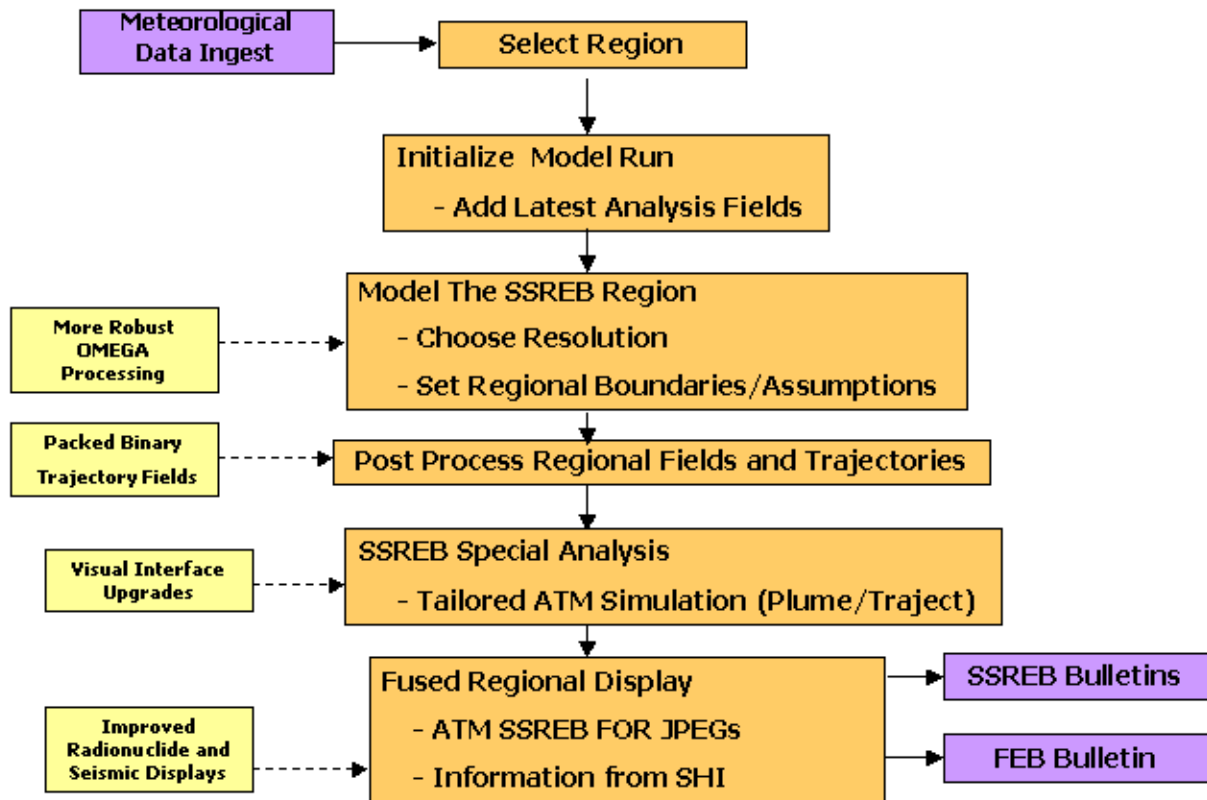


Figure 2. SSREB (OMEGA) Operations Flow.

developed for PIDC 7.0 operations. Figure 2 shows the general flow of simulation data and FOR products for event operations using the high resolution OMEGA atmospheric transport model. As with Figure 1, the boxes on the left side of the figure with the dotted lines indicate the upgraded capabilities developed for PIDC 7.0 operations.

- **Update to daily operations procedures to included review and accounting of graphic FOR postings**

The daily operations procedures will be updated for PIDC 7.0 operations to include the review and monitoring of daily, graphical ATM FOR product postings. The following procedures are proposed for PIDC 7.0 operations:

- > Graphical FORs are to be posted for the HYSPLIT simulation processing within 48 hours after collection stop. The graphical FORs are to be posted for HYSPLIT simulation processing 96 hours after collection stop during weekends.

- > Daily 24, 48, and 72-hour graphical FORs are to be produced from the coarse resolution, HYSPLIT model simulation processing for the 15 active, daily reporting radionuclide stations. These 15 stations and the FORs are to be included in the ATM summary portion of the PIDC Quarterly Report. The report will include a table with information on the station names, a summary of 24, 48, and 72 hour FORs available for the report period, and the average number of days required to post the graphical FORs to the PIDC web directory. Up to 20 stations will be included in the daily HYSPLIT graphical FOR postings for PIDC 7.0 operations.
- > One 7 and one 14 day network graphical FOR per week are to be posted from the coarse resolution HYSPLIT model simulation processing. This posting will also be included in the quarterly report.
- > OMEGA graphical FORs are to be posted within 72 hours of collection stop, or within 72 hours of event notification for two stations identified by the radionuclide operations staff. These two stations are either the review sites scheduled on a routine basis by radionuclide operations staff, or a combination of the routine stations and stations identified as measuring radionuclides which are classified as level 4 or 5 categories. A summary of these stations and the level 4 or 5 stations, along with the graphical FORs posted for these stations, will also be included in the quarterly report. The posting time for the graphical FORs will be relaxed to 96 hours over a weekend period.

Possible Risks and Dependencies

The risks associated with the operations installation of the PIDC 7.0 software are the following:

- Denial of access to the NOAA/NCEP ftp site: execution of the atmospheric transport models requires access to the analysis and forecast fields available on the NCEP site. Continuous ATM operations, both OMEGA and HYSPLIT, depend on access to this ftp site. Denial of access to this site is a risk to the continuous ATM operations. We consider this risk to be minimal since over the past year ATM processing was denied access to the site only when NCEP experienced a catastrophic computer failure. This computer failure was unexpected and was quickly resolved.
- Unexpected change of NCEP data format: the NCEP data format changed unexpectedly once during the past year. The result was an interruption to continuous OMEGA and HYSPLIT ATM processing until a patch was created to overcome the change in data format. We consider this risk to be minimal since the NCEP data format was changed unexpectedly only once during the past year. NOTE: there was one additional format change which occurred as a result of Y2K four-digit year requirement. This change was corrected with a one-time fix.
- The nature of the PIDC operations infrastructure support for ATM and visual processing: the operations processing for ATM and visual analysis software is outside the operations LAN and results in some risk regarding the overall evaluation of operations processing. This risk is mitigated as much as possible by ensuring that the linkages to the seismic and radionuclide databases are planned in advance. However, when changes are made which affect these linkages, and the transfer of product files to operational databases, this may result in disruption to ATM product operations.

EDGE data display and ATM processing dependencies associated with the installation of PIDC 7.0 relate to connection to the following databases:

- Radionuclide database: EDGE displays the data from the RN database. In addition, the ATM processing includes active stations as specified in the RN station list. We request coordination on changes to the station list for ATM processing and on changes to other database fields for visual data display.
- Radionuclide database: the EDGE display of radionuclide stations colorized according to the sample categorization level. We request coordination on any changes to database names to ensure proper connection to the correct radionuclide Oracle database.
- Seismic database: the EDGE display of 3D seismic event data requires connectivity to the SHI Oracle database through the EDGE API. This connectivity allows for the coloration and display of SHI events according to depth, depth error, and body-wave magnitude. In addition, the SHI measuring sites may be displayed by different icons based on whether the sites have hydroacoustic measurement capability.
- Radionuclide web product databases: the output of FORs to the correct HTML address for particular stations and events will support RRR and SSREB reporting. These FORs will be output in graphical form for each radionuclide station in the active database.

Summary of Testing

All applications were unit tested before release. Unit tests were extended to test new features of PIDC 7.0. CSCI 1 software operated as expected for the unit testing. Detailed results are given in the internal unit test summaries currently filed with the atmospheric transport and visual analysis software technical managers. A summary of the test results is provided in Appendix A, Table 1 and Appendix D, Table 3.

During the last four weeks integration testing was completed on segments of the operations software. In addition with the exception of EDGE, over the last 2 weeks we have tested the operational components of the ATM software on the testbed. The results of this testing is summarized at Appendix E. Additional testing on the testbed was initiated on 11 August. This testing will provide an assessment of the capability to complete operations processing of both OMEGA and HYSPLIT continuously on Spinach--an Enterprise configured machine. Note that this Enterprise system is not a duplicate of the IDC Enterprise. However, this PIDC machine is the only machine available for Enterprise testing. Note the discussion on PIDC 7.0 infrastructure under Risks and Dependencies section.

Initial integration testing of the Spinach ATM output was also completed in the last two weeks. Included in these tests were the operations integration of the Spinach output in the EDGE display. The ATM output was generated in the operational formats and ingested into EDGE using the operational scripts which are included with the software. Additionally, the seismic and radionuclide manager output displays were tested. The results of this testing are also summarized at Appendix E.

One additional point must be addressed regarding Enterprise testing. The ATM and visual processing software MUST be planned, and accounted for when completing the schedule for PIDC

8.0/IDC Release 4 testbed testing. Any delays such as those encountered for the PIDC 7.0 testbed access WILL adversely affect the validation and testing of the PIDC 8.0 and the subsequent delivery of the IDC Release 4 software to the IDC.

Unit testing is also summarized for individual CSC's included in the ATM and visual analysis CSCI at Appendix E.

Schedule and Plan for Implementation

Installation of the Atmospheric Transport Operations and Visual Analysis Processing software for PIDC 7.0 will follow the general Plan for Implementing PIDC 7.0 into PIDC Operations. As a general rule this plan allows for a 5-day installation period followed by a two-week break in period prior to stabilizing operations. The one change to this plan is the atmospheric transport operations software will not be installed in the same hardware configuration planned for implementation into the IDC. However, we have established a period for testing which will allow the atmospheric transport operations software to be installed on a similar IDC hardware architecture. This testing period and the overall schedule and plan for implementation is provided below.

- **OMEGA 5.0 Atmospheric Transport Operations Software:** The installation of the atmospheric transport operations software will include all components required for PIDC operations. Software will be installed according to the dates specified below and will require the specified personnel from SAIC/CAP to complete the installation. The installation will include verification of the operating system compatability and patch level required to support the OMEGA and HYSPLIT software.
 - **July 21 through August 10:** Software installed on Spinach (Enterprise 4000, 6-248 MHz processors and 1.5 GB) for multiprocessor operations evaluation. This installation would be a PIDC operations installation if there was a dedicated Enterprise system available on the testbed for ATM processing. Individuals planned to complete the PIDC testbed installation are Mr Tom Dunn and Mr. Mark Turner, SAIC/CAP. During this period the OMEGA and HYSPLIT processes will be evaluated for bugs based on processing of the operations software components running end-to-end.
 - **August 11 through 20:** IDC Enterprise hardware architecture testing and evaluation on Spinach. We anticipate a minimum of four days of continuous ATM processing during this period to evaluate processing speed improvements and output times.
 - **August 21 through August 25:** Upgrade of Tomato (OMEGA) and Nimbus (HYSPLIT) to Solaris 7 operating system.
 - **August 21 through August 31:** Software installed on Tomato (OMEGA) and Nimbus (HYSPLIT) (Ultra 60s) for PIDC operations and validation testing. This installation will be to complete PIDC 7.0 operations and testing configuration. Individuals planned to complete the PIDC operations installation are Mr Tom Dunn and Mr. Mark Turner, SAIC/CAP.
NOTE: this is not the preferred hardware architecture to complete PIDC operations and validation testing since it is not similar to the IDC Enterprise server architecture.

- **August 21 through September 15:** Operations test and evaluation period for ATM processing. During this period minor bug fixes will occur to mitigate operational software issues which are not PIDC 7.0 operations show stoppers. The **validation testing** is scheduled to begin on **29 August**.
- **September 18:** Initiation of PIDC 7.0 Operations processing on Tomato and Nimbus.
- **EDGE 3.6, Patch 4, Visual Analysis Processing Software:** The installation of the visual analysis and processing software will include the upgrade of EDGE to Version 3.6 Patch 4, and the integrated radionuclide and seismic data display interfaces required for PIDC 7.0 operations. Installation will require the specified persons from Autometric over a two-day period for the initial installation and an additional two days to verify the proper data base interface connectivity. During the installation of these components, the operating system and patch level for the necessary graphical and database interfaces.
 - **July 17 through July 31:** EDGE and associated patches listed at Appendix C for PIDC 7.0 installed on Cumulus including verification of database connectivity to the PIDC 7.0 radionuclide and seismic databases.
 - **July 24 through July 31:** EDGE atmospheric transport analysis output processing initiated. Connectivity to the radionuclide RRR station product output addresses verified. In addition, during this period evaluation will begin on the capability to receive SSREB messages for SSREB product support. This testing will be coupled with the atmospheric transport processing software.
 - **August 21 through September 15:** Formal test and evaluation of the PIDC 7.0 operations software will be initiated and the process of bug fixes will be tracked for determination of show stoppers. The **validation testing** is scheduled to begin on **29 August**
 - **August 21 through September 15:** Evaluation of fixes to Medium severity problems listed at Appendix D, Table 3.
 - **September 18:** Initiation of PIDC 7.0 Operations processing for visual analysis software on Cumulus.

Costs and Resources Required for Implementation

It is estimated that implementation of PIDC 7.0 as a whole will require two integration and Operations staff members 2 days. This effort will be concentrated on upgrading the nimbus and tomato operating systems to Solaris 2.7. In addition, approximately 1 man week of effort will be required to resolve any problems encountered during the first week of operations testing. The process of bug fixes during the August test and evaluation will require .5 man months to monitor both the atmospheric transport and visual analysis processing software. The installation planning was completed previously.

References

Biegalski, S., C. Powell, C. Reinehart, Analyst Instructions for Radionuclide Data, IDC Technical Instruction 6.2.6, March 1999.

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Appendix A: Software Components Covered in this Volume

Table 1 shows a summary of testing of the software components of CSCI 1 for PIDC 7.0.

Table 1: Computer Software Components for PIDC 7.0

CSCI/CSC		UNIT TESTED ¹	INTEGRATION TESTED ON PIDC TESTBED	FIXED DATA SET
1 Automatic Processing				
1.11	Atmospheric Model Processing			
	OMEGA 5.0	yes	yes	no
	HYSPLIT Version 3.0	yes	yes	no
1.11.1	Automatic Processing		NOTE 2	
1.11.1.1	readgrib	yes	yes	no
1.11.1.2	scangrib	yes	yes	no
1.11.1.3	mirror.pl	yes	yes	no
1.11.1.4	sort_mrf.csh	yes	yes	no
1.11.1.5	fetch_mrf.csh	yes	yes	no
1.11.1.6	runprep	yes	yes	no
1.11.1.7	gridgen	yes	yes	no
1.11.1.8	surfggen	yes	yes	no
1.11.1.9	prepdatt	yes	yes	no
1.11.1.10	geninit	yes	yes	no
1.11.1.11	analysis	yes	yes	no
1.11.1.12	adm_src	yes	yes	no
1.11.1.13	omegamodel	yes	yes	no
1.11.1.14	adm2for	yes	yes	no
1.11.1.15	prune	yes	yes	no
1.11.1.16	adm2adm	yes	yes	no
1.11.1.17	adm2trj	yes	yes	no
1.11.1.18	split_mrf	yes	yes	no
1.11.1.19	hysplit	yes	yes	no
1.11.1.20	hymodel.out.ba	yes	yes	no
1.11.1.21	hymodel.out.ffa	yes	yes	no

Table 1: Computer Software Components for PIDC 7.0

CSCI/CSC		UNIT TESTED ¹	INTEGRATION TESTED ON PIDC TESTBED	FIXED DATA SET
1.11.1.22	getmaxid	yes	yes	no
1.11.1.23	date	yes	yes	no
1.11.1.24	cmvk.csh	yes	yes	no
1.11.1.25	clwc.csh	yes	yes	no
1.11.1.26	cdtd.csh	yes	yes	no
1.11.1.27	umvk.csh	yes	yes	no
1.11.1.28	ulwc.csh	yes	yes	no
1.11.1.29	automatic.weatherdata	yes	yes	no
1.11.1.30	hyfor2archive	yes	yes	no
1.11.1.31	rrr_update	yes	yes	yes
1.11.2	Interactive Processing			
1.11.2.1	xgrid	yes	yes	no
1.11.2.2	xomega	yes	yes	no
1.11.2.3	positn	yes	yes	no
1.11.3	Data Management			
1.11.3.1	cleanhy.csh	yes	yes	no
1.11.4	System Monitoring			
1.11.4.1	runstat	yes	yes	no
2 COTS Software				
EDGE	Version 3.6, Patch 4	yes	yes	yes

1. All unit testing included Y2K tests.

2. Testing on the IDC testbed for automatic processing is scheduled to be in phased in starting on 21 July with continuous automatic processing running 11 through 18 August.

Appendix B: R3 Data Format Specification for ATM Data Processing Results.

The following specifications provide the formats for the PIDC 7.0 ATM data processing results to be delivered for R3.

ATM Field of Regard Format Specification

Field-of-Regard and Network Performance File (.for) Content and Formats

T. Dunn

May 23, 2000

OMEGA and HYSPLIT particle output files can be postprocessed using the adm2for.f code to create field-of-regard (FOR) and network performance (NP) analyses. The field-of-regard file (.for) is created for OMEGA forward forecast simulations and HYSPLIT forward forecast and forward analysis simulations. The network performance file (.for) is created for HYSPLIT backward analysis simulations. The format and file content of the network performance file is the same as that of the field-of-regard file. In addition, both files, field-of-regard and network performance, are written as ASCII-formatted files.

The naming convention for field-of-regard files is: *station id name (NNNNN), model simulation ('om' = omega; 'hy' = hysplit), start date of the model simulation (YYYYMMDD), mode of the model simulation ('ff' = forward forecast; 'fa' = forward analysis; 'ba' = backward analysis), followed by a '.for' suffix*. An example named field-of-regard file is: *RN064.om.20000522.ff.for* (station RN064, omega simulation, start date: May 22, 2000, forward forecast).

The naming convention for network performance files is: *'network.' prefix, model simulation ('om' = omega; 'hy' = hysplit), start date of the model simulation (YYYYMMDD), mode of the model simulation ('ff' = forward forecast; 'fa' = forward analysis; 'ba' = backward analysis), followed by a '.for' suffix*. An example named network performance file is: *network.hy.20000522.ba.for* (hysplit simulation, start date: May 22, 2000, backward analysis).

Field-of-Regard File Content and Formats

line 1:

Description -----	Units -----	Array -----	Type -----	Format -----
Simulation end time	YYYYMMDDHHmm		character	a12

Write format: (a12)

Line 2:

Description -----	Units -----	Array -----	Type -----	Format -----
FOR analysis times	hours	tmstop-tmstrt	real	f6.1

Write format: ('lat', 6x, 'lon', 9x, 14(f6.1, 12x))

Line 3 through the number of FOR analysis points (N_{for})+2:

Description -----	Units -----	Array -----	Type -----	Format -----
FOR analysis point latitude	degrees	rel_lat	real	f6.2
FOR analysis point longitude	degrees	rel_lon	real	f9.2
FOR analysis point value		field	real	e15.7

Write format: (f6.2, f9.2, 14(e15.7, 1x))

Network Performance (e.g., network.hy.20000522.ba.for) File Content and Formats

line 1:

Description -----	Units -----	Array -----	Type -----	Format -----
Simulation start time	YYYYMMDDHHmm		character	a12

Write format: (a12)

Line 2:

Description -----	Units -----	Array -----	Type -----	Format -----
NP analysis times	hours	tmstop-tmstrt	real	f6.1

Write format: ('lat', 6x, 'lon', 9x, 14(f6.1, 12x))

Line 3 through the number of NP analysis points (N_{np})+2:

Description -----	Units -----	Array -----	Type -----	Format -----
NP analysis point latitude	degrees	rel_lat	real	f6.2
NP analysis point longitude	degrees	rel_lon	real	f9.2
NP analysis point value		field	real	e15.7

Write format: (f6.2, f9.2, 14(e15.7, 1x))

Units

degrees	decimal degrees; longitude written with reference to east longitude
YYYYMMDDHHmm	Year, Month, Day, Hour, minutes

ATM Particle File Format Specification

Particle Output File (.adm) Content and Formats

T. Dunn

May 23, 2000

Particle output files (.adm) contain time snapshots of particle locations and properties. The files are written at user-specified time intervals, usually every one hour of model simulation time. The use of particles during an OMEGA simulation is optional. To activate the Atmospheric Dispersion Model (ADM) in OMEGA that writes the particle output files, the OMEGA model run setup file “omega.i” must list: *yesadm = .true*. The HYSPLIT model writes particle output files by default.

The ADM in OMEGA can simulate the dispersion of material using two different diffusion models. One model (*puff*) assumes that each particle released is the centroid of a puff of uniformly-distributed material whose volume increases over time. A second model (Lagrangian particle model – *lpm*) assumes that each particle released is a discrete mass of material. The choice of diffusion model for an OMEGA simulation is specified on the fourth line in the OMEGA model run setup file “omega.adm”. If the line reads *puff*, the puff model will be activated. If the line reads *lpdm*, the lpm model will be activated. The HYSPLIT model can use only puffs to simulate the dispersion of material.

The naming convention of particle output files is: YYYYMMDDHHmm.adm where HHmm represents UTC time. If the user specifies *oldouts = .true.*, in the “omega.i” run setup file before starting the simulation, the filenames will be derived from the case name and the time of output. These filenames will have the form: caseidDHHmmz.adm where *caseid* is a four character name, *D* is the simulation day number, and *HHmm* represents UTC time. If the user also specifies a non-zero value for the variable *nthist* in the “omega.i” run setup file, the filenames will have the form: ‘itr_’,*ntime*,’.adm’ where *ntime* is the model output iteration number.

The particle output can be written as ASCII-formatted or packed binary files. To write the particle output files as packed binary in OMEGA, the OMEGA model run setup file “omega.i” must list: *yesadmpkb = .true*. Otherwise, the OMEGA particle output files will be written as ASCII-formatted files. To write HYSPLIT particle output as packed binary, the last line of the “DEFAULT.DAT” HYSPLIT input file must read: *p*. To write ASCII-formatted files in HYSPLIT, the last line must read: *a*. The content of a particle output file, whether ASCII-formatted or packed binary, depends on which diffusion model was specified prior to the beginning of the simulation.

ASCII-formatted files use the same Fortran format for both *puff* and *lpm* diffusion model

output, however, some of the quantities that are written to the file depend on which diffusion model was selected for the simulation.

Packed binary files have a default set of particle information that is written to the file. The default information is followed by conditional particle information. The content of the conditional particle information written depends on the diffusion model that was selected for the simulation.

Particle Output Packed Binary File Content and Formats

Default Parameters (written for both *puff* and *lpm* diffusion model output):

Field ID -----	Type -----	Label -----	Description -----	Units -----
iprt_td	integer	ADM Output Time	Time output file is written	s
iprt_id	integer	ADM Release ID	Release point ID number	
iprt_pid	integer	ADM Particle ID	Particle ID number	
prt_lat	real	ADM Latitude	Particle latitude	degrees
prt_lon	real	ADM Longitude	Particle longitude	degrees
prt_alt	real	ADM Altitude	Particle altitude	m-MSL
prt_hav	real	ADM Terrain Height	Ground altitude	m-MSL
prt_t0	real	ADM Injection Time	Particle injection time	s

Additional Parameters (written only for *puff* diffusion model output):

prt_mss	real	ADM Puff Mass	Mass of material in puff	kg
prt_sx	real	ADM Puff Sigma-X	Puff <i>x</i> -standard deviation	m
prt_sy	real	ADM Puff Sigma-Y	Puff <i>y</i> -standard deviation	m
prt_sz	real	ADM Puff Sigma-Z	Puff <i>z</i> -standard deviation	m

Additional Parameters (written only for *lpm* diffusion model output):

prt_mss	real	ADM Particle Mass	Mass of discrete particle	kg
prt_rhd	real	ADM Particle Density	Density of discrete particle	kg/m ³
prt_d	real	ADM Particle Diameter	Diameter of discrete particle	m

Particle Output ASCII-Formatted File Content and Formats*line 1:*

Description -----	Units -----	Variable -----	Type -----	Format -----
Output time	s	time	real	f10.2
Dummy variable		dum	real	f10.2
Output iteration number		ntime	integer	i8
Number of particles (N_p)		numid	integer	i7
Simulation start date/time	YYYYMMDDHHmm	mdate0	integer	i4.4,i8.8
Simulation output date/time	YYYYMMDDHHmm	mdate	integer	i4.4,i8.8

Write format: (2f10.2, 1x, i8, 1x, i7, 1x, i4.4, i8.8, 1x, i4.4, i8.8)*Lines 2 through N_p+1 :*

Description -----	Units -----	Array -----	Type -----	Format -----
Release point ID number		iprt_id	integer	i5
Release level ID number		iprt_lv	integer	i3
Particle ID number		iprt_pid*iprt_kp	integer	i7
Particle latitude	degrees	prt_lat	real	f7.3
Particle longitude	degrees	prt_lon	real	f8.3
Particle altitude	m-MSL	prt_alt	real	f9.2
Particle release time	s	prt_t0	real	f8.0
Ground altitude	m-MSL	prt_hav	real	f7.2
Particle density	kg/m ³	prt_rhd	real	f7.2
Puff vapor concentration	kg/m ³	prt_vap	real	e10.3
Puff x-standard deviation	m	prt_sx	real	f9.2
Puff y-standard deviation	m	prt_sy	real	f9.2
Puff z-standard deviation	m	prt_sz	real	f9.2
Particle mass	kg	prt_mss	real	e10.3
Particle diameter	m	prt_d	real	e10.3

Write format: (i5, 1x, i3, 1x, i7, 1x, f7.3, 1x, f8.3, 1x, f9.2, 1x, f8.0, 1x, f7.2, 1x, f7.2, 1x, e10.3, 1x, f9.2, 1x, f9.2, 1x, f9.2, 1x, e10.3, 1x, e10.3)

Units

degrees	decimal degrees; longitude written with reference to east longitude
m	meters
m-MSL	meters-above Mean Sea Level
s	seconds
kg	kilograms
YYYYMMDDHHmm	Year, Month, Day, Hour, minute

Sample “omega.i” Setup File

```
$omegain
caseid = cs008,
runid = 2000010900,
timetag = 200001090000,
tmax = 6,
dtfactor = 1.4,
dtdump = 1.0,
rstdump = 1.0,
numbcf = 7,
bcfile = 200001090000.bc,
bcfile = 200001091200.bc,
bcfile = 200001100000.bc,
bcfile = 200001101200.bc,
bcfile = 200001110000.bc,
bcfile = 200001111200.bc,
bcfile = 200001120000.bc,
yesadp = .false.,
icoarse = 1,
adpfac = 2.0,
itrigger = 1,
dtadp = 1.0,
yesadm = .true.,
yesadmpkb = .true.,
yesstat = .true.,
yesconc = .false.,
yesmic = .true.,
radmold = .false.,
$end
```

Sample Puff Diffusion Model "omega.adm" Setup File

```

50000
1
tracer
puff
1 24.08 53.50 20.00 0.0 21600. 1. 0.0 0.016666666667 0.0 0.0 0.0 0.0 0.0 1

```

Sample Puff Diffusion Model ASCII-Formatted ADM File Excerpt

```

21611.52      0.00      804      804 200001090000 200001090600
1 1      1 54.131 25.188 164.70      0. 161.71      0.00 0.000E+00 5907.78 5907.78
4025.22 0.167E-01 0.000E+00
1 1      2 54.131 25.189 165.08      27. 161.69      0.00 0.000E+00 5904.53 5904.53
4022.26 0.167E-01 0.000E+00
1 1      3 54.130 25.189 165.44      54. 161.66      0.00 0.000E+00 5901.54 5901.54
4019.40 0.167E-01 0.000E+00
1 1      4 54.129 25.189 165.83      81. 161.64      0.00 0.000E+00 5898.39 5898.39
4016.52 0.167E-01 0.000E+00
1 1      5 54.128 25.189 166.20     108. 161.62      0.00 0.000E+00 5896.09 5896.09
4014.05 0.167E-01 0.000E+00
1 1      6 54.127 25.190 166.60     134. 161.61      0.00 0.000E+00 5894.24 5894.24
4011.73 0.167E-01 0.000E+00
1 1      7 54.126 25.189 166.72     161. 161.55      0.00 0.000E+00 5887.81 5887.81
4007.18 0.167E-01 0.000E+00
1 1      8 54.124 25.184 166.54     188. 161.34      0.00 0.000E+00 5866.37 5866.37
3995.47 0.167E-01 0.000E+00
1 1      9 54.124 25.186 167.07     215. 161.38      0.00 0.000E+00 5869.82 5869.82
3995.66 0.167E-01 0.000E+00
1 1     10 54.123 25.184 167.10     242. 161.28      0.00 0.000E+00 5858.36 5858.36
3988.77 0.167E-01 0.000E+00
1 1     11 54.123 25.186 167.63     269. 161.33      0.00 0.000E+00 5862.66 5862.66
3989.36 0.167E-01 0.000E+00
1 1     12 54.120 25.181 167.42     296. 161.11      0.00 0.000E+00 5840.41 5840.41
3977.31 0.167E-01 0.000E+00
1 1     13 54.121 25.186 168.21     323. 161.27      0.00 0.000E+00 5855.83 5855.83
3983.15 0.167E-01 0.000E+00
1 1     14 54.119 25.181 168.00     349. 161.06      0.00 0.000E+00 5833.66 5833.66
3971.15 0.167E-01 0.000E+00
1 1     15 54.118 25.182 168.51     376. 161.07      0.00 0.000E+00 5833.99 5833.99
3969.83 0.167E-01 0.000E+00
1 1     16 54.118 25.181 168.66     403. 161.02      0.00 0.000E+00 5828.55 5828.55
3965.75 0.167E-01 0.000E+00
1 1     17 54.117 25.182 169.15     430. 161.04      0.00 0.000E+00 5830.14 5830.14
3964.98 0.167E-01 0.000E+00
1 1     18 54.116 25.182 169.31     457. 161.00      0.00 0.000E+00 5824.76 5824.76
3960.92 0.167E-01 0.000E+00
1 1     19 54.115 25.177 169.17     484. 160.82      0.00 0.000E+00 5806.24 5806.24
3950.64 0.167E-01 0.000E+00
1 1     20 54.114 25.177 169.33     511. 160.77      0.00 0.000E+00 5800.97 5800.97
3946.64 0.167E-01 0.000E+00
1 1     21 54.113 25.177 169.82     538. 160.76      0.00 0.000E+00 5799.68 5799.68
3944.56 0.167E-01 0.000E+00

```

1	1	22	54.112	25.177	169.99	564.	160.72	0.00	0.000E+00	5794.47	5794.47
3940.57	0.167E-01	0.000E+00									
1	1	23	54.112	25.178	170.50	591.	160.73	0.00	0.000E+00	5795.17	5795.17
3939.39	0.167E-01	0.000E+00									
1	1	24	54.111	25.177	170.67	618.	160.69	0.00	0.000E+00	5789.98	5789.98
3935.42	0.167E-01	0.000E+00									
1	1	25	54.109	25.172	170.48	645.	160.48	0.00	0.000E+00	5768.38	5768.38
3923.70	0.167E-01	0.000E+00									
1	1	26	54.110	25.177	171.31	672.	160.64	0.00	0.000E+00	5783.99	5783.99
3929.47	0.167E-01	0.000E+00									
1	1	27	54.108	25.174	171.22	699.	160.49	0.00	0.000E+00	5767.80	5767.80
3920.32	0.167E-01	0.000E+00									
1	1	28	54.107	25.172	171.35	726.	160.41	0.00	0.000E+00	5759.37	5759.37
3914.77	0.167E-01	0.000E+00									
1	1	29	54.107	25.174	171.96	753.	160.45	0.00	0.000E+00	5762.61	5762.61
3914.79	0.167E-01	0.000E+00									
1	1	30	54.106	25.173	172.14	780.	160.40	0.00	0.000E+00	5757.47	5757.47
3910.83	0.167E-01	0.000E+00									
1	1	31	54.105	25.173	172.32	806.	160.36	0.00	0.000E+00	5752.35	5752.35
3906.88	0.167E-01	0.000E+00									
1	1	32	54.103	25.168	172.13	833.	160.15	0.00	0.000E+00	5730.80	5730.80
3895.19	0.167E-01	0.000E+00									
1	1	33	54.102	25.167	172.31	860.	160.11	0.00	0.000E+00	5725.73	5725.73
3891.26	0.167E-01	0.000E+00									

Sample LPM Diffusion Model "omega.adm" Setup File

```

50000
2
tracer
lpdm
1 24.08 53.50 20.00 0.0 21600. 1. 1.0e-6 2.0e-15 2000.0 0.0 0.0 0.0 0.0 1
2 24.08 53.50 1000.0 0.0 21600. 1. 5.0e-5 2.5e-10 2000.0 0.0 0.0 0.0 0.0 1

```

Sample LPM Diffusion Model ASCII-Formatted ADM File Excerpt

```

21611.52      0.00      804      1608 200001090000 200001090600
  1  1      1  54.164  25.380  268.00      0. 168.04 2000.00 0.000E+00      0.00      0.00
0.00 0.200E-14 0.100E-05
  2  1     -2  53.729  24.854  143.55      0. 143.55 2000.00 0.000E+00      0.00      0.00
0.00 0.250E-09 0.500E-04
  1  1      3  54.204  25.300  253.35     27. 167.31 2000.00 0.000E+00      0.00      0.00
0.00 0.200E-14 0.100E-05
  2  1     -4  53.754  24.947  143.11     27. 143.11 2000.00 0.000E+00      0.00      0.00
0.00 0.250E-09 0.500E-04
  1  1      5  54.156  25.196  190.03     54. 162.78 2000.00 0.000E+00      0.00      0.00
0.00 0.200E-14 0.100E-05
  2  1     -6  53.756  25.006  143.41     54. 143.41 2000.00 0.000E+00      0.00      0.00
0.00 0.250E-09 0.500E-04
  1  1      7  54.290  25.606  245.75     81. 177.31 2000.00 0.000E+00      0.00      0.00
0.00 0.200E-14 0.100E-05
  2  1     -8  53.719  24.757  143.72     81. 143.72 2000.00 0.000E+00      0.00      0.00
0.00 0.250E-09 0.500E-04
  1  1      9  54.200  25.683  457.86    108. 177.47 2000.00 0.000E+00      0.00      0.00
0.00 0.200E-14 0.100E-05
  2  1    -10  53.848  25.189  151.65    108. 151.65 2000.00 0.000E+00      0.00      0.00
0.00 0.250E-09 0.500E-04
  1  1     11  54.314  25.969  444.07    134. 189.23 2000.00 0.000E+00      0.00      0.00
0.00 0.200E-14 0.100E-05
  2  1    -12  53.713  24.778  143.83    134. 143.83 2000.00 0.000E+00      0.00      0.00
0.00 0.250E-09 0.500E-04
  1  1     13  54.105  25.078  251.53    161. 157.81 2000.00 0.000E+00      0.00      0.00
0.00 0.200E-14 0.100E-05
  2  1    -14  53.773  25.023  144.48    161. 144.48 2000.00 0.000E+00      0.00      0.00
0.00 0.250E-09 0.500E-04
  1  1     15  54.297  25.734  354.38    188. 181.75 2000.00 0.000E+00      0.00      0.00
0.00 0.200E-14 0.100E-05
  2  1    -16  53.746  24.884  143.24    188. 143.24 2000.00 0.000E+00      0.00      0.00
0.00 0.250E-09 0.500E-04
  1  1     17  54.129  25.074  206.27    215. 158.56 2000.00 0.000E+00      0.00      0.00
0.00 0.200E-14 0.100E-05
  2  1    -18  53.795  25.034  145.57    215. 145.57 2000.00 0.000E+00      0.00      0.00
0.00 0.250E-09 0.500E-04
  1  1     19  54.239  25.661  425.63    242. 178.26 2000.00 0.000E+00      0.00      0.00
0.00 0.200E-14 0.100E-05
  2  1    -20  53.748  24.861  143.21    242. 143.21 2000.00 0.000E+00      0.00      0.00
0.00 0.250E-09 0.500E-04
  1  1     21  54.079  25.017  197.57    269. 155.22 2000.00 0.000E+00      0.00      0.00

```

0.00	0.200E-14	0.100E-05									
2	1	-22	53.763	25.009	143.75	269.	143.75	2000.00	0.000E+00	0.00	0.00
0.00	0.250E-09	0.500E-04									
1	1	23	54.299	25.979	443.24	296.	188.97	2000.00	0.000E+00	0.00	0.00
0.00	0.200E-14	0.100E-05									
2	1	-24	53.852	25.267	153.90	296.	153.90	2000.00	0.000E+00	0.00	0.00
0.00	0.250E-09	0.500E-04									
1	1	25	54.278	26.197	522.89	323.	194.04	2000.00	0.000E+00	0.00	0.00
0.00	0.200E-14	0.100E-05									
2	1	-26	53.725	24.874	143.62	323.	143.62	2000.00	0.000E+00	0.00	0.00
0.00	0.250E-09	0.500E-04									
1	1	27	54.307	25.793	253.06	349.	183.40	2000.00	0.000E+00	0.00	0.00
0.00	0.200E-14	0.100E-05									
2	1	-28	53.735	24.819	143.43	349.	143.43	2000.00	0.000E+00	0.00	0.00
0.00	0.250E-09	0.500E-04									
1	1	29	54.128	25.512	393.71	376.	170.29	2000.00	0.000E+00	0.00	0.00
0.00	0.200E-14	0.100E-05									
2	1	-30	53.779	25.021	144.65	376.	144.65	2000.00	0.000E+00	0.00	0.00
0.00	0.250E-09	0.500E-04									
1	1	31	54.162	25.213	177.25	403.	163.46	2000.00	0.000E+00	0.00	0.00
0.00	0.200E-14	0.100E-05									
2	1	-32	53.725	24.828	143.62	403.	143.62	2000.00	0.000E+00	0.00	0.00
0.00	0.250E-09	0.500E-04									

ATM OMEGA Atmospheric Field Format Specification

OMEGA Fields File (.pkb, .out) Content and Formats

T. Dunn

May 23, 2000

OMEGA fields files contain 3-dimensional time snapshots of all the significant OMEGA fields which can be used for post-processing purposes. The files are written at user-specified time intervals, usually every one hour of model simulation time. By default, the OMEGA fields files are written as packed binary files (.pkb). To write the fields files as unformatted files (.out), the user must add *oldouts = .true.*, to the “omega.i” run setup file before starting the simulation.

The naming convention of the OMEGA fields packed binary output files is: YYYYMMDDHHmm.pkb, where HHmm represents UTC time. The naming convention of the OMEGA fields unformatted files is derived from the case name and the time of output. The filenames have the form: caseidDHHmmz.out where *caseid* is a four character name, *D* is the simulation day number, and *HHmm* represents UTC time. If the user specifies a non-zero value for the variable *nthist* in the “omega.i” run setup file, the filenames have the form:

‘itr_’, ntime, ‘.out’ where *ntime* is the model output iteration number.

OMEGA Fields Packed Binary File Content and Formats

Field ID -----	Type -----	Label -----	Units -----
uvel	real	U Velocity	m/s
vvel	real	V Velocity	m/s
wvel	real	W Velocity	m/s
tpres	real	Pressure	mb
pres	real	Pressure Pert	mb
temp	real	Temperature	°C
theta	real	Potential Temperature	K
rho	real	Air Density	kg/m ³
kappam	real	Kappam	
qvap	real	Vapor Concentration	kg/m ³
qdrop	real	Cloud Droplet Concentration	kg/m ³
qice	real	Cloud Ice Concentration	kg/m ³
qrain	real	Rain Concentration	kg/m ³
qsnow	real	Snow Concentration	kg/m ³
cloud	real	Cloud Concentration	kg/m ³
precip	real	Precipitation Concentration	kg/m ³
precip_gnd	real	Total Precip on Ground	mm
clcov	real	Cloud Cover	
cumpreci	real	cumulus precipitation	mm
cumcover	real	cumulus cloud cover	
hpbl	real	Boundary Layer Height	m
tground	real	Ground Temperature	K
sst	real	OMEGA Sea Surface Temperature	°C
vort	real	Vorticity	
hlatent	real	Latent Heat	K
sratio	real	Saturation Ratio	
potmoist	real	Thetae	K
convmois	real	Total moisture convergence	kg/m ² /s
LCL	real	LCL	m
tlcl	real	temperature at lcl	K
cumdtmp	real	Differential cloud temperature	K
cumdvap	real	Differential cloud moisture	gm/kg
cumheat	real	cumulus heating	K/hr

cumoist	real	cumulus moisture	gm/kg/hr
cumdrop	real	cumulus drop	kg/m ³
cumice	real	cumulus ice	kg/m ³
rmsk	real	Time-splitting Masks	

OMEGA Fields Unformatted File Content and Formats

Description -----	Units -----	Variable -----	Type -----
Name of the simulation		runid	character
Output time	s	time	real
Output iteration number		ntime	integer
Simulation start year	YYYY	iyear0	integer
Simulation start month	MM	imonth0	integer Simu-
lation start day	DD	idate0	integer
Simulation start time	HHmm	iztime0	integer
Number of grid levels		nr	integer
Number of grid vertices		nv	integer
Number of grid edges		ne	integer
Number of grid cells		nc	integer
Number of grid boundary edges		neb	integer
Vertex coordinates		xv	real
Vertex radial unit vector components			xvunit real
Vertex alt. above the ref. sphere	m	xv3d	real
Components of linear momentum	kg/m ² /s	vel	real
Pressure perturbation	mb	pres	real
Energy density	kgK/m ³	ergdens	real
Air density	kg/m ³	rho	real
Vapor concentration	kg/m ³	qvap	real
Cloud droplet concentration	kg/m ³	qdrop	real
Cloud ice concentration	kg/m ³	qice	real
Rain concentration	kg/m ³	qrain	real
Snow concentration	kg/m ³	qsnow	real
Saturation ratio		sratio	real
Eulerian tracer concentration	kg/m ³	utrc1	real
Eulerian tracer concentration	kg/m ³	utrc2	real
Eulerian tracer concentration	kg/m ³	utrc3	real
Eddy diffusivity	/m ²	kappam	real

Eddy diffusivity	/m ²	kappah	real
Precipitation concentration	kg/m ³	precip	real
Boundary layer height	m	hpbl	real
Cumulus precipitation	mm	cumpreci	real
Cumulus cloud cover		cumcover	real
Surface heat flux	W/m ²	hflx	real
Ground temperature	K	tground	real

Units

m	meters
mm	millimeters
kg	kilograms
gm	grams
s	seconds
°C	degress Celsius
K	Kelvin
hr	hours
mb	millibars
W	Watts
YYYY	year
MM	month
DD	day
HHmm	hour, minutes

ATM OMEGA Concentration Field Format Specification

OMEGA Concentration Output File (.con) Content and Formats

T. Dunn

May 24, 2000

OMEGA concentration output files (.con) contain time snapshots of the 3-D distribution of an effluent released during an OMEGA simulation. The files are written at user-specified time intervals, usually every one hour of model simulation time. The calculation of concentrations during an OMEGA simulation is optional. To activate the concentration calculation routines, the

OMEGA model run setup file “omega.i” must list: *yesconc = .true.* and *yesecon = .true.* followed by an output interval at which the files will be written, (e.g., *dtconc = 1.0*).

The OMEGA concentrations are calculated on a dynamically-adapting structured 3-D receptor grid that is overlaid on the OMEGA unstructured grid. The dimensions of the structured receptor grid are a function of particle latitude, longitude, altitude, and puff properties. The default number of equally-spaced vertical levels at which concentrations are calculated is fixed at 11. Thus, the altitudes at which each of the 11 vertical levels is located may change over time and depends on the depth of the atmosphere through which the puffs range. The default number of latitude and longitude receptor grid points is fixed at 300 each.

The naming convention of concentration output files is: YYYYMMDDHHmm.con where HHmm represents UTC time. If the user specifies *oldouts = .true.*, in the “omega.i” run setup file before starting the simulation, the filenames will be derived from the case name and the time of output. These filenames will have the form: caseidDHHmmz.con where *caseid* is a four character name, *D* is the simulation day number, and *HHmm* represents UTC time. If the user also specifies a non-zero value for the variable *nthist* in the “omega.i” run setup file, the filenames will have the form: ‘itr_’,*ntime*,’.con’ where *ntime* is the model output iteration number. The concentration output is written as ASCII-formatted files.

OMEGA Concentration Output ASCII-Formatted File Content and Formats

Description -----	Units -----	Variable -----	Type -----	Format -----
Simulation start date/time	YYYYMMDDHHmm	mdate0	character	a12
Simulation output date/time	YYYYMMDDHHmm	mdate	character	a12
Number of latitude points		nylat	integer	i4
Number of longitude points		nxlon	integer	i4
Number of altitude levels		nzalt	integer	i4
Latitude grid points	degrees	rcptr(i,j,1,2)	real	e15.7
Longitude grid points	degrees	rcptr(i,j,1,1)	real	e15.7
Altitude of the grid surface	m-MSL	thgtmsl	real	e15.7
Concentration	kg/m ³	concen	real	e15.7

Units

degrees	decimal degrees; longitude written with reference to east longitude
m	meters
m-MSL	meters-above Mean Sea Level
kg	kilograms
YYYYMMDDHHmm	Year, Month, Day, Hour, minute

Appendix C: Patches to PIDC 7.0 Operations Software

Table 2 lists patches for EDGE 3.6 to be delivered with PIDC 7.0 which are part of CSCI 1.

Table 2: Patches to PIDC 7.0

Release	Software/Patch	Description	Date
PIDC_7.0	EDGE 3.6, Service Pack 1	EPF 3.6, EDGE Core 3.6, Service Pack 1	6/23/2000
PIDC_7.0	EDGE Documentation	EPF 3.6, Online Reference Guide 3.6	7/05/2000

Appendix D: Outstanding Problems for CSCI 1: Automatic Processing

Table 3 lists problems identified during testing which have not yet been addressed along with an indication of their severity:

- *High* this problem should be addressed before promotion to PIDC operations
- *Medium* this problem should be addressed before R3 is delivered to Vienna
- *Low* this problem can be addressed after R3 is delivered to Vienna.

Table 3: Outstanding Problems for CSCI 1: Automatic Processing

CSCI/CSC		PROBLEM	SEVERITY
1 Automatic Processing			
1.11.1	ATM Simulation Data Generation		
1.11.1.X	automatic.weatherdata	Creation of 72-hour particle animations were not verified during unit testing	Medium
1.11.1	Particle Data Conversion		
1.11.1	EDGE Environmental Work Bench	The conversion of particles from a 72-hour global HYSPLIT model output was not verified during unit testing	Medium
1.11.1	ATM packed binary output		
1.11.1	HYSPLIT and OMEGA	Output format of ATM .adm packed binary data has a problem and a fix is progress. Some additional investigation and testing during the scheduled test phase will be required.	Medium
1.11.2	Interactive Processing		
1.11.2	EDGE Radionuclide Manager	Display of radionuclide stations according to sample categorization level will require changes to accomodate the PIDC 7.0 Radionuclide database.	Medium

Appendix E: Testing Procedures and Results

All applications, with the exceptions noted in Table 1, were unit tested before release to the PIDC Integration Testbed. This testing was performed under Solaris 2.7 and Oracle 8.1.5.0.0. The internal unit testing results are documented and on file with the technical managers for the atmospheric transport and visual analysis processing software.

The PIDC 7.0 release was planned for integration testing on the PIDC testbed during June. This integration testing will be completed 21 July through 18 August, and will follow testing objectives of the Validation Test Plan. A report summarizing the results of this testing will be filed as an addendum to this document.

A summary of the unit testing is provided below. Much more detail is available in the test summary documents. A key part of the unit testing was the verification of data results in the standard output directories. This directory structure for OMEGA and HYSPLIT is provide in Table 4.

NOTE: A critical component of the testing procedures is the verification of the proper configuration of the /etc/system file of the operating system. The critical requirements at a high level are checking to ensure a 24-bit X server and a MIT Magic Cookie.

System Processing

1.11 OMEGA 5.0 Model Processing

1.11.1 OMEGA Automatic Processing Components

Unit testing completed at SAIC/CAP in house which utilized the software components listed in Table1 (Appendix A), under 1.11.1, Automatic Processing. Verification of the following high-level components were completed as part of the unit testing:

- Raw data ingest from NCEP ftp site.
 - Tested and verified on spinach for both OMEGA and HYSPLIT.
- Processing of grib data fields.
 - Tested and verified on spinach.
- OMEGA model processing for region of interest
 - Test and verified on spinach.
- Output of OMEGA model data results: particle files (.adm in pkb format); concentration file (.con format); meteorological fields (.out format); and region and/or station-specific field of regard files (.for format).
 - Test and successfully output data on spinach. NOTE: the .adm pkb format is not correct in the most recent version of ATM processing and a fix is in progress. This will require additional testing on the testbed before PIDC operations has this capability.

1.11.1 HYSPLIT Automatic Processing Components

Unit testing completed at SAIC/CAP in house which utilized the software components listed in Table1 (Appendix A), under 1.11.1, Automatic Processing. Verification of the following high-level components were completed as part of the unit testing:

- Raw data ingest from NCEP ftp site.
 - Successfully tested on spinach.
- Processing of grib data fields.
 - Successfully tested on spinach.
- HYSPLIT model processing for global monitoring area.
 - Successfully completed global run on spinach.
- Output of HYSPLIT model data results: particle files (.adm in pkb format); and station-specific field of regard files (.for format).
 - Successfully completed output of HYSPLIT simulation on spinach. NOTE: the .adm pkb format is not correct in the most recent version of ATM processing and a fix is in progress. This will require additional testing on the testbed before PIDC operations has this capability.

1.11.1 EDGE Automatic Processing Components

Unit testing completed at Autometric/EAD and CMR/pIDC which utilized the EDGE automatic.weather data and rrr_update scripts listed in Table 1 (Appendix A), under 1.11.1. Verification of the following high-level components were completed as part of the unit testing:

- Conversion and ingest of OMEGA and HYSPLIT field of regard (FOR) data results into the EDGE visual analysis system.
 - Successfully completed conversion of OMEGA and HYSPLIT FOR data from spinach output files.
- Output of EDGE manually created JPEG images to RRR web location using rrr_update script.
 - Successfully completed JPEG FOR images and rrr_update script ready for PIDC 7.0 testing.

1.11.2 OMEGA Interactive Processing Components

- Generation OMEGA atmospheric transport model run from manual, interactive input regional and point specific coordinate information.
 - Successfully generated OMEGA regional and point specific simulations.
- Verification of output data results from manual, interactive processing for data results listed under automatic processing: .out, .for, .adm (pkb), and .con files.
 - Successful generation of simulation output files. NOTE the .adm packed binary issues will affect this test objective also.

1.11.2 EDGE Interactive Processing Components

- Generation of manual, interactive analysis results for visual display with other PIDC monitoring data. These other data types include SHI and RN site/event data.
 - Successfully generated seismic displays with EDGE seismic manager. However, as specified in Appendix D, Table 3, there is additional bug fixing required to display the new PIDC 7.0 radionuclide data. These changes were identified and are in progress.
- Generation of event summary ATM simulation data and FOR products for recreation of event sequence. These recreation simulations include visual animations and screen captures which allow event review.
 - Sample ATM simulation products were completed. The simulation product capabilities were verified for all but the .adm packed binary simulation results. This capability will be verified during the next 30 days of testing.

1.11.3 Data Management

- Basic components were unit tested for functionality.
 - Successfully tested OMEGA and HYSPLIT processing and also verified the simulation output was written according to the new directory structure.

1.11.4 System Monitoring

- Basic components were unit tested for functionality.
 - Verified the usage of runstat to monitor processing.

Output Directory Structure Verification

Table 4: OMEGA and HYSPLIT Output Directory Structure

Model	Output	Directory Path	Output Size*
OMEGA	Particle .adm, pkb	/atmdata1/ops/caseid/YYYYMMDDHH	500 MB
OMEGA	FOR .for	/atmdata1/ops/caseid/YYYYMMDDHH	1 MB
OMEGA	Concentration .con	/atmdata1/ops/caseid/YYYYMMDDHH	1 GB
OMEGA	Met. Fields .out	/atmdata1/ops/caseid/YYYYMMDDHH	1 GB
HYSPLIT	Particle .adm, pkb	/atmdata2/ops/YYYYMMDDHH/fwrд_fcst	1 GB
		/atmdata2/ops/YYYYMMDDHH/fwrд_anly	1 GB
		/atmdata2/ops/YYYYMMDDHH/back_anly	1 GB
HYSPLIT	FOR, Network .for	/atmdata2/ops/YYYYMMDDHH/fwrд_fcst	1 MB
		/atmdata2/ops/YYYYMMDDHH/fwrд_anly	1 MB
		/atmdata2/ops/YYYYMMDDHH/back_anly	1 MB

Caseid is the five character station or event case identification, e.g., RN064 would be a station caseid.

YYYYMMDDHH is the model start date and time, e.g., 2000052300 would be 00 GMT (HH) on day 23 (DD) of the fifth month (MM) in the year 2000 (YYYY).

fwrd_fcst implies the output was generated from the forward forecast

fwrd_only implies the output was generated from the forward analysis

back_only implies the output was generated from the backward analysis

* The output sizes are estimated and are dependent on grid size and temporal resolution.

ATM and Visual Operations Process Time Summary

Table 5. Process Timing Test Results.

Software	Process	Time to Complete	Size of Output	Platform
OMEGA	Particle .adm, pkb	12 hours	500 MB	Spinach
OMEGA	FOR .for	1 hour	1 MB	Spinach
OMEGA	Concentration .con	3 hours	500 MB	Spinach
OMEGA	Met. Fields .out	3 hours	200 MB	Spinach
HYSPLIT	Particle .adm, pkb	5 hours	1 GB	Spinach
HYSPLIT	FOR, Network .for	1 hour	1MB	Spinach
EDGE	HYSPLIT FOR processing	.5 hour	100 KB	Cumulus
EDGE	HYSPLIT .adm processing	1.75 hours	600 MB	Cumulus
EDGE	OMEGA FOR processing	.05 hour	100 KB	Cumulus
EDGE	OMEGA .adm processing	1.5 hours	500 MB	Cumulus

PIDC Testbed Processing Output Directories

Table 6: PIDC Testbed Output Directories for ATM Processing

Model	Output	Directory Path	Machine
OMEGA	OMEGA simulation results	/data/spinach/omega/atmdata1/ops	Spinach
HYSPLIT	HYSPLIT simulation results	/data/spinach/omega/atmdata2/ops	Spinach

PIDC 7.0 SDR Summary

Table 7. IDC Software Defect Reports Addressed During Testing and Development.

SDR #	Priority	Applicable Software	Brief Description
SDR-066	Important	ATM	Updates to MRF meteorological data feed documentation--R4 CLOSURE
SDR-067	Important	ATM/HYSPLIT	Updates to coarse resolution HYSPLIT ATM processing--R4 CLOSURE
SDR-068	Important	ATM/OMEGA	Updates to high resolution OMEGA ATM processing--R4 CLOSURE
SDR-069	Important	EDGE Processing	Updates to the EDGE visual processing system--R4 CLOSURE
SDR-070	Important	ATM/HYSPLIT	HYSPLIT Sleep Mode for incomplete meteorological data--CLOSED
SDR-071	Important	ATM/HYSPLIT	HYSPLIT core dump for incomplete meteorological data--CLOSED
SDR-072	Important	ATM/OMEGA	OMEGA Sleep Mode for incomplete meteorological data--CLOSED
SDR-073	Important	ATM/OMEGA	OMEGA core dump for incomplete meteorological data--CLOSED
SDR-076	Important	EDGE Processing	EDGE OMEGA boundaries incorrect--CLOSED
SDR-077	Important	EDGE Processing	EDGE 72-hour ADM import core dump--CLOSED
SDR-078	Important	ATM/OMEGA	OMEGA_for_arch fails for empty date--CLOSED
SDR-079	Important	ATM/OMEGA	OMEGA_for_arch fails for case directories--CLOSED
SDR-080	Important	ATM/OMEGA	OMEGA_for_arch Email script incomplete--CLOSED
SDR-122	Important	EDGE Processing	EDGE core dump during ADM animation--CLOSED

SDR #	Priority	Applicable Software	Brief Description
SDR-135	Critical	ATM/HYSPLIT	Y2K HYSPLIT processing--CLOSED with R2.1
SDR-136	Critical	ATM/OMEGA	Y2K OMEGA processing--CLOSED with R2.1
SDR-137	Critical	ATM/OMEGA	Y2K OMEGA output files--CLOSED with R2.1
SDR-142	Critical	ATM/HYSPLIT	HYSPLIT Y2K Patch IDC_2.1.11 fix--CLOSED with R2.1 fix
SDR-143	Critical	ATM/OMEGA	OMEGA Y2K Patch IDC_2.1.11 fix--CLOSED with R2.1 fix
SDR-155	Important	EDGE Processing	EDGE Permission for User Group--CLOSED with R3 Install
SDR-156	Important	ATM/OMEGA	OMEGA Single point emission core dump--CLOSED
SDR-157	Important	EDGE Processing	EDGE seismic manager database connection--CLOSED
SDR-167	Critical	ATM/OMEGA	OMEGA produces not a number results--CLOSED
SDR-168	Important	EDGE Processing	EDGE automatic.weatherdata time stamp incorrect--CLOSED
SDR-169	Routine	EDGE Processing	EDGE radionuclide manager default time cannot be updated--CLOSED
SDR-170	Critical	ATM/OMEGA	OMEGA processing core dumps for Southern Hemisphere--CLOSED
SDR-175	Routine	EDGE Processing	EDGE representation of OMEGA wind fields incorrect--CLOSED
SDR-177	Critical	ATM/HYSPLIT	HYSPLIT hyfor2archive does not work for Y2K--TESTING FIX for CLOSURE
SDR-178	Routine	EDGE Processing	EDGE radionuclide manager data retrieval is incomplete for RN meteorological data--CLOSED

Appendix F: Sun Solaris 2.7 System Requirements

The PIDC 7.0 software operates on the standard PIDC Solaris 2.7 installation. We expect this same operating system at the IDC.

EDGE requires a minimum of 300MB of free space on the root drive for operation on a Sun operating system.

Appendix G: Radionuclide and Seismic Data Visual Display Overview

The PIDC 7.0 EDGE software interfaces include the capability to display both radionuclide station data and seismic event data. These interfaces read data from the radionuclide and seismic Oracle database schema and display the information interactively while operating the EDGE software. The interfaces and the display of data is dependent on whether the EDGE software is connected to the correct version of the Oracle database. For example, an older version of this software was installed as part of IDC Release 2 and during the installation the display of these data was verified. However, in October of last year the Oracle database names for the seismic data were changed and upon making this change the EDGE display capability for seismic event data was interrupted. When made aware of this name change we provided the IDC with instructions on how to change the database specification to allow the resumption of the seismic data display. This same requirement for correctly calling the database name exist for the radionuclide Oracle database.

For PIDC 7.0 additional enhancements were made to both the EDGE seismic and radionuclide display managers. The capabilities added for PIDC 7.0 are provided below.

EDGE Seismic Data Display Manager Enhancements

- Overview of data display components included with the seismic manager
 - Display of seismic event locations from REB, SEL1, SEL2, SEL3 databases.
 - Display of seismic stations part of the IMS monitoring system.
 - Display of seismic error ellipses from each database.
 - Display of 3D seismic ellipsoids at depth for each database.
 - Display via interactive “picking on the event or station” of seismic table information including stations, arrivals, etc. All interactive picking displays are based on the EDGE clock time.
 - Colorization of events based on body wave magnitude, depth, and depth error.
 - Notional propagation of seismic wave from event icon.
 - Display of tracks associated with seismic event id and the detecting station. This provides a moving track radiating out from the event to the station detecting the event. So, if there were five stations detecting the event, there are five traces or tracks which develop on the timescale identical to the time required for the signal to travel to the station.
- PIDC 7.0 Enhancements
 - Continuous accumulation of events for a given clock interval as specified with the EDGE clock.
 - Display of events based on a bounding rectangle.
 - Colorization of events which have a specific body wave magnitude, depth, or depth error. This includes the capability to edit a color pallet and make one value a specific color, or make a range of values a specific color.

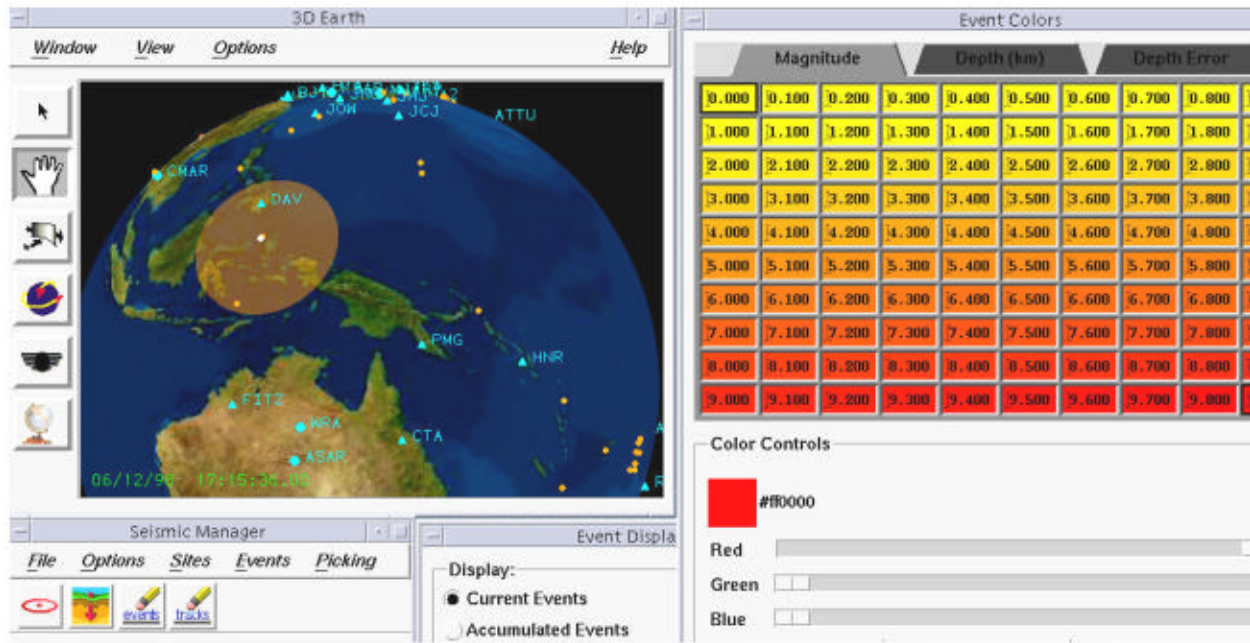


Figure 3. EDGE display of seismic data via the seismic manager.

EDGE Radionuclide Data Display Manager Enhancements

- Overview of data display components included with the seismic manager.
 - Display of radionuclide station location as specified in the radionuclide database
 - Display via interactive “picking on the radionuclide station” of station information such as collection start and collection stop, sample id and level, meteorological information, and station location information. All interactive picking displays are based on the EDGE clock time and thus the collection start and stop will be associated with the closest sample based on the time specified on the EDGE clock.
 - Display of colored radionuclide station according to the sample categorization level.
 - Display of meteorological data observed at the station in the standard WMO station model format.
- Enhancements included with the PIDC 7.0 software.
 - Colorization of the stations according to the specific times listed for collection start and stop categorizations in the station sample database.
 - A sample display of the data is available on cumulus in the PIDC Situation Room.